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AUTHOR Rezba, Richard J.
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ABSTRACT

The author suggests ways reading can be integrated with science and describes the reading activities in an elementary science methods course. The activities include: (1) selecting a science tradebook for children to review and for the teacher to analyze vocabulary; (2) helping children review science tradebooks; and (3) encouraging independent reading and investigation by preparing instructional cards. Several sources of children's readings in science are included. (SA)

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Elementary Science and Reading Activities for Teacher Educators

Richard J. Rezba
Virginia Commonwealth University

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The term "crowded curriculum" is often used to justify the exclusion of science from an elementary school program. This exclusion of science is further intensified by the recent "back to the basics" movement. Gains made in science elementary schools in the sixties may be lost in the face of increasing pressure to exclude "non-essential" subjects. One approach to counteract this movement is to demonstrate how science and reading can be effectively and successfully integrated. The purpose of this paper is to describe reading activities conducted in elementary science methods. These activities are designed to relate reading to science and to develop skills and attitudes in preservice teachers that will enable them to effectively integrate science and reading. The topic of science and reading is introduced by making a large number of children's tradebooks in science available for perusal by the preservice teachers. A discussion follows on how reading in science text and tradebooks differs from that of basal readers. Some of these differences are:

students are accustomed to reading narration materials and not the terse language of scientific writing.

the number of concepts introduced on a page or within a chapter is generally not controlled in science books. The number of concepts introduced in a specified space affects the readability of the material and science materials are particularly loaded in this respect.

control of vocabulary and sentence complexity is extensive in basal readers and generally limited in science reading materials.

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The major instructional approach to integrating science and reading is through modeling integrated science and reading activities. The preservice teachers study the major elementary science programs (ESS, SCIS and S-APA), as well as other curricular materials, and participate in activities from each. In every case, children's readings related to the topic are present and used. Their principal use results from questions that arise during the course of investigating the materials at hand. The ESS unit, Budding Twigs, for example, provides the basis for many questions about new growth in the spring. Most questions of both a factual and conceptual level can be answered by using the children's tradebooks. Direct experiences such as these provide a basis for discussing purposeful reading and the role of science as a motivator to reading.

Science can be a powerful motivator to read and that interest can be skillfully channeled to develop much needed content area reading skills. Questions resulting from direct experience with materials will often provide an incentive or purpose on the part of the children to find answers to their questions through reading. Reading is done for a purpose and not just for the sake of reading. Such a purposeful quest for answers to important questions provides opportunities for students to be exposed to all sorts of sources for gathering information related to their questions. Among these sources are science tradebooks, textbooks, science sections of basal readers and children's magazines such as Ranger Rick. Skills such as locating information, using parts of a book, and reading graphs can also be taught in the context of something that has already captured the children's interest.

The statement that what a child brings to reading influences what he gets from reading provides a powerful rationale to implementing exploration and investigation activities in science. Students will then have background

experience that will help them understand what they are reading as well as provide the motivation to read about something in the first place.

Although emphasis is on children's tradebooks in science, the use of textbook series and children's periodicals is also included. Sources of children's readings in science are investigated as well. These include AAAS Science Books, Subject Guide to Children's Books in Print, catalogs from tradebook "jobbers", and publishers' information on such offerings as the "Let's-read-and-find-out" science books. The additional use of children's readings as sources of information for the teacher is discussed. This unusual use of tradebooks is particularly comforting to many preservice teachers lacking both the background and the confidence to teach science.

The topic of selecting and evaluating science reading materials includes identifying and illustrating factors contributing to the reading level. Numerous techniques are reviewed from "eyeballing it" to readability formulas. The formula devised by Fry (1968) is applied to representative readings in science for children. This particular technique is used because of its predictive accuracy and uncommon simplicity. Although there is considerable controversy over readability measures, this exercise does provide a means for attending to two variables affecting reading level vocabulary and sentence complexity. The manner in which these variables are measured provided the added opportunity to apply the science process skill of operationally defining variables. The procedure consists of selecting three 100-word passages at random and counting both the number of syllables and the average number of sentences per 100 words. The resulting values are plotted on a readability graph to determine the approximate reading level. The true level may be different due to such other influencing factors as writing style, organization patterns and the use of formulae, symbols and graphic aids. Another technique for determining readability is

also explored. The Cloze technique has the added advantage of measuring readability in terms of an individual student's comprehension. This method involves selecting a reading passage, deleting every fifth word and replacing those words with blanks of equal length until a total of 50 words have been omitted. The first and last sentences are left intact. Students are given copies and asked to fill in the blanks with the words they believe have been omitted. The completed papers are scored by giving points for each correct answer. A score of 60 and above indicates an easy level, a score between 41 and 60 indicates a functioning level where teacher assistance may occassionally be needed and a score of 40 and below indicates the frustrational level for both the student and teacher.

Determining the readability of science materials will always be somewhat difficult. Polysyllabic words are common in science and may artificially raise the apparent reading level of the material. Most preservice teachers view technical vocabulary as the important factor contributing to the reading difficulty of science materials. Yet, there is considerable evidence (Mallinson, 1971) that children have greater difficulty with non-technical vocabulary in science writings than they do with the technical. Unaware of this, teachers ordinarily concentrate on new scientific terms to the exclusion of the other vocabulary (Smith, 1972). Non-technical vocabulary includes general words (some of which may be particulary difficult, e.g. significance, particles, fragment, etc.) and special words. Special words are those that take on a new meaning when used in a science context, e.g. bulb, cycle, attracts, multiply, etc.

The opportunity for preservice teachers to integrate science and reading is provided through designing and implementing science activities for their peers. In addition, field experience provides most students a classroom situation in which to implement science/reading instruction.

Classroom teachers have been particulary supportive of this type of instruction. Other activities that provide the framework for developing and practicing integrated reading and science skills are 1. reviewing a science tradebook, 2. having children review a science tradebook and 3. encouraging independent reading and investigation

Science Tradebook Review

Choose a science tradebook for children on a topic in which you are interested. Read the book carefully, comment on 1. the content, 2. the appealing features of the book or the lack thereof, and 3. its readability.

Using the "Fry Graph" and/or another technique for estimating readability, determine the approximate grade level of the book. Analyze the vocabulary by locating and listing general, special and technical words that may cause difficulty for the reader. "Special" words should be given in context and their new meaning explained.

A Child's View

During your science unit of instruction, have your students do a review of one of the tradebooks they are using. Explain to the children that what you are requesting is not a book report, but rather their opinion of what they liked and did not like about the book they have chosen to review.

After reading the children's reviews, what comments can you make about their attitude toward these books? Are there any opinions that the children have in common? Do their comments suggest any characteristics you might keep in mind when selecting future science tradeoooks for your children?

These reviews were written by fourth grade children when studying ocean life:

"The book was interesting Not at all hard but Not to easy so I would not like it. It was very unstandable it was a good book. It was not too long and boring and the pictures were great. It told about snails, mussels and

burnacles."

"It was a graet book for geting facts...Even tho I did not read the hole thing I could tell it was good and the pictures are really good."

"It was huge print and had neat information. It was easy to understand and it had good pictures. It is very short. I think it's a good book."

"It not a very good book because it just tell about the boy and girl are saying stuf about the shell they found."

"They have very good facts. And it was easy to read. The book was very good. The book was not to long..."

Encouraging Independent Reading and Investigation

Choose a tradebook that includes activities or experiences for a child to do. Provide materials (in a shoebox or other suitable container) and the following management and instructional cards for the book so that a child can independently complete the suggested activities in the book.

Consult with your teacher regarding an appropriate topic and use his/her classroom.

Card 1: Design a management card (this is needed if the "box" is housed later in a library or resource center and is checked out with the book). Include such items as name of borrower, room number, date borrowed, date due.

Card 2: Write the necessary instructions for the child to complete the activities.

Card 3: Related bibliography. List other books available on same subject (Use standard bibliographic format).

Card 4: List materials contained in the box.

Card 5: Note substitutions for equipment (e.g. a baby food jar instead of a beaker).

Card 6: List rules for using the kit; e.g. return material to box, cap bottles tightly, procedures for replacing broken or depleted materials, etc.

Worksheet: Design a means for students to self-test their understandings of the activities.